Name:_____ Group:__ Mark: __ /70 Grade: __

Answer **all** questions. 1 hour 15 minutes

1 (a) Describe what is meant by the term *IDE (Integrated Development Environment)*.

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(b) Identify and describe **three** features commonly found in an IDE that will help programmers to find any bugs in their code.

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... **[6]**

2 The array queue shown below is set up to hold a small queue. Assume that there is sufficient storage to hold all necessary additions to the queue.

Queue

Rear Front

The table below shows variables that are used to maintain the queue:

Variable	Type	Purpose
front	integer	pointer to the front element of the queue
rear	integer	pointer to the rear element of the queue
Queue_full	Boolean	indicates whether the queue is full
max	integer	the maximum size of the queue

Shown below is an algorithm that is intended to add an item to the queue.

```
procedure add_to_queue (item)
     if ((front – rear) +1) == max then
          queue_full=true
     else
          front=front + 1
          queue[front]=item
     endif
endprocedure
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(a) Identify the parameter that is passed to this procedure.

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(b) Describe the logical decision that is made.

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(c) (i) This algorithm contains a logic mistake. Explain what the mistake is.

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(ii) Rewrite the algorithm to correct the mistake.

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3 (a) Describe **one** difference between a global and a local variable.

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(b) Explain, using **one** example, why global variables are sometimes used in a program.

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(c) Explain why good programming practice generally avoids the use of global variables.

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(d) Explain why parameter passing to a function can be a better alternative to using global variables.

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4 Nobugs is a software development company that produces enterprise-wide management software for large companies. Its software products are built up from many program functions.
The managers of Nobugs enforce standard rules on their programmers about how program functions should be written.
The following are some of the rules that they insist upon:

- no function may be longer than a single page of code
- variable identifiers must conform to a standard convention
- each function must have a single entry point
- variables must not be set up outside the scope of a function
- hardware-specific code must be avoided
- embedded documentation must be adequate.

(a) Describe what is meant by a function.

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(b) Compare a program procedure with a function.

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(c) A programmer at Nobugs has written some program code that includes two user defined functions.

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function my_function1(number)
     return number*number*number
endfunction

function my_function2(number)
     return number*number*number*number
```

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endfunction

number=int(input("Enter a number "))
print(my_function1(number))
print(my_function2(number))
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(i) Apart from the two functions written by the programmer, identify **two** other functions used in this piece of program code.

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(ii) The programmer tests this code with the input value of 3. State the output that would be obtained.

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(d)* Nobugs enforces standard rules about writing functions on its programmers. Discuss the reasons why this might be the case.

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5 A car has a feature in its engine management system that is intended to save fuel and emissions produced when the car is waiting at traffic lights or in a traffic jam. The default option is that if the gears are disengaged and the car is not moving, the engine is switched off. There is a display on the dashboard that indicates when the engine has been switched off in this way. However, sometimes it is necessary to keep the engine running even when the car is stationary, in order to provide electric power to charge the battery, run the heater, run the air conditioning system or keep the lights on. This, in turn, is affected by the external and internal temperatures, the settings chosen by the driver and the intensity of light outside.

(a) Identify **four** inputs needed by this feature of the engine management system.
For each suggest a suitable data type for its storage.
[8]

Input	Data Type

(b) Identify **two** outputs from this engine management feature.

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(c) Write an algorithm that would produce the results described for this engine management system feature.

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6 DriveSim Tutor is a 3D driving simulator program designed to allow learner drivers to practice following the Highway Code whilst driving through a virtual town.
The simulator's developers study a real town. They then use abstraction on their findings before designing a virtual town.
(a) Explain why it is necessary for the developers to use abstraction.

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(b) As a result of abstraction there will be similarities and differences between the virtual and real town.

(i) State **two** similarities there might be between the virtual and real town. Explain why these similarities exist.

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(ii) State **two** differences between the virtual and real town.

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(c) A road in the town has a “no overtaking” sign.

Describe how the simulator would check the driver obeys this sign whilst on this road.

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